

Many elevator installers and repairers also receive training to become familiar with a company's particular equipment from their employers or through manufacturers. Retraining is very important to keep abreast of technological developments in elevator repair. In fact, union elevator constructors typically receive continual training throughout their careers, either through correspondence courses, seminars, or formal classes. Although voluntary, this training greatly improves one's chances for promotion.

Some installers may receive further training in specialized areas and advance to mechanic-in-charge, adjuster, supervisor, or elevator inspector. Adjusters, for example, may be picked for the position because they possess particular skills or are seen to be electronically inclined. Other workers may move into management, sales, or product design jobs.

### Job Outlook

Employment of elevator installers and repairers is expected to increase as fast as the average for all occupations through the year 2008, but relatively few new job opportunities will be generated because the occupation is small. Replacement needs, another source of jobs, also will be relatively low. This is, in part, because a substantial amount of time is invested in specialized training that yields high earnings, so workers tend to remain in these jobs. The job outlook for new workers is largely dependent on activity in the construction industry, and opportunities may vary from year to year as conditions within the industry change. Job prospects should be best for those with postsecondary training in electronics or more advanced formal education.

Demand for elevator installers and repairers will increase as equipment ages and needs repairs and as the construction of new buildings with elevators and escalators increases. Growth also should be driven by the need to continually update and modernize old equipment, including improvements in appearance and the installation of increasingly sophisticated equipment and computerized controls. Because it's desirable that equipment be always kept in good working condition, economic downturns will have less of an effect on employment of elevator maintenance and repair mechanics than on other occupations. The need for people to service elevators and escalators should increase, as equipment becomes more intricate and complex.

### Earnings

Median hourly earnings of elevator installers and repairers in 1998 were \$23.01. The middle 50 percent earned between \$18.41 and \$32.20. The lowest 10 percent earned less than \$14.22 and the top 10 percent earned more than \$40.70.

In addition to free continuing education, elevator installers and repairers receive basic benefits enjoyed by most other workers.

The proportion of elevator installers and repairers who are union members is higher than nearly any other occupation. Almost 75 percent of elevator installers and repairers are members of a union, compared to 14 percent in all occupations, and 22 percent for other craft and repair occupations. Most elevator installers and repairers belong to the International Union of Elevator Constructors.

### Related Occupations

Elevator installers and repairers combine electrical and mechanical skills with construction skills, such as welding, rigging, measuring, and blueprint reading. Other occupations that require many of these skills are boilermaker, electrician, industrial machinery repairer, millwright, sheet metal worker, and structural and reinforcing metal workers.

### Sources of Additional Information

For further details about opportunities as an elevator installer and repairer, contact elevator manufacturers, elevator repair and maintenance contractors, a local of the International Union of Elevator Constructors, or the nearest local public employment service office.

## Glaziers

(O\*NET 87811)

### Significant Points

- Glaziers learn the trade on the job, either through a formal apprenticeship or by working as helpers to experienced glaziers.
- Glazier employment is expected to increase slowly due to the slow growth anticipated in construction.

### Nature of the Work

Glass serves many uses in modern buildings. Insulated and specially treated glass keeps in warmed or cooled air, and provides good condensation and sound control qualities; tempered and laminated glass makes doors and windows more secure. In large commercial buildings, glass panels give skyscrapers a distinctive look while reducing the need for artificial lighting. The creative use of large windows, glass doors, skylights, and sun room additions make homes bright, airy, and inviting.

Glaziers are the workers responsible for selecting, cutting, installing, replacing, and removing all types of glass. They generally work on one of several types of projects. Residential glazing involves work such as replacing glass in home windows, installing glass mirrors, shower doors and bathtub enclosures, and glass for table tops and display cases. On commercial interior projects, glaziers install items such as heavy, often etched, decorative room dividers and windows with speak holes and security glazing. Glazing projects may also involve replacement of storefront windows for establishments such as, supermarkets, auto dealerships, and banks. In the construction of large commercial buildings, glaziers build metal framework extrusions and install glass panels or curtainwalls.

Besides working with glass, glaziers may also work with plastics, granite, marble, and similar materials used as glass substitutes. They may mount steel and aluminum sashes or frames and attach locks and hinges to glass doors. For most jobs, the glass is precut and mounted in frames at a factory or a contractor's shop. It arrives at the job site ready for glaziers to position and secure it in place. They may use a crane or hoist with suction cups to lift large, heavy pieces of glass. They then gently guide the glass into position by hand.

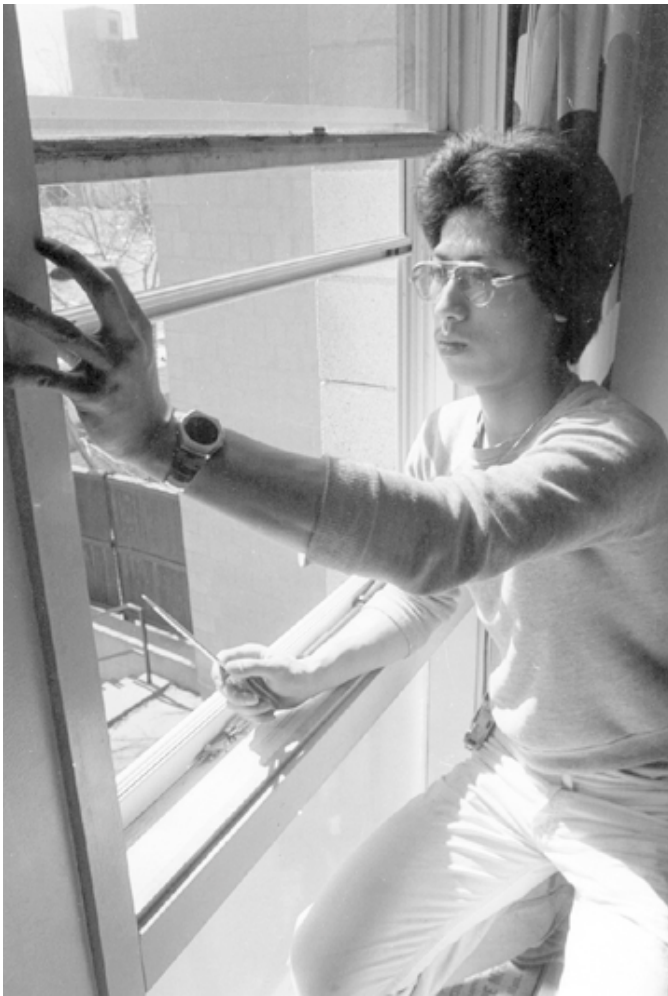
Once glaziers have the glass in place, they secure it with mastic, putty, or other pastelike cement, or with bolts, rubber gaskets, glazing compound, metal clips, or metal or wood molding. When they secure glass using a rubber gasket—a thick, molded rubber half-tube with a split running its length—they first secure the gasket around the perimeter within the opening, then set the glass into the split side of the gasket, causing it to clamp to the edges and hold the glass firmly in place.

When they use metal clips and wood molding, glaziers first secure the molding to the opening, place the glass in the molding, and then force spring-like metal clips between the glass and the molding. The clips exert pressure and keep the glass firmly in place.

When a glazing compound is used, glaziers first spread it neatly against and around the edges of the molding on the inside of the opening. Next, they install the glass. Pressing it against the compound on the inside molding, workers screw or nail outside molding that loosely holds the glass in place. To hold it firmly, they pack the space between the molding and the glass with glazing compound and then trim any excess material with a glazing knife.

For some jobs, the glazier must cut the glass manually at the job site. To prepare the glass for cutting, glaziers rest it either on edge on a rack or "A-frame," or flat against a cutting table. They then measure and mark the glass for the cut.

Glaziers cut glass with a special tool that has a very hard metal wheel about 1/6 inch in diameter. Using a straightedge as a guide, the glazier presses the cutter's wheel firmly on the glass, guiding and rolling it carefully to make a score just below the surface. To help the cutting tool move smoothly across the glass, workers brush a thin layer of oil



*Glaziers constantly lift, bend, and kneel.*

along the line of the intended cut or dip the cutting tool in oil. Immediately after cutting, the glazier presses on the shorter end of the glass to break it cleanly along the cut.

In addition to handtools such as glass cutters, suction cups, and glazing knives, glaziers use power tools such as saws, drills, cutters, and grinders. An increasing number of glaziers use computers in the shop or at the job site to improve their layout work and reduce the amount of glass that is wasted.

### **Working Conditions**

Glaziers often work outdoors, sometimes in inclement weather. At times, they work on scaffolds at great heights. They do a considerable amount of bending, kneeling, lifting, and standing. Glaziers may be injured by broken glass or cutting tools, falls from scaffolds, or from improperly lifting heavy glass panels.

### **Employment**

Glaziers held about 44,000 jobs in 1998. About 3 out of every 5 glaziers worked for glazing contractors engaged in new construction, alteration, and repair. About 1 out of 5 worked in retail glass shops that install or replace glass and for wholesale distributors of products containing glass. Others worked in automotive repair stores.

### **Training, Other Qualifications, and Advancement**

Many glaziers learn the trade informally on the job. They usually start as helpers, carrying glass and cleaning up debris in glass shops. They often practice cutting on discarded glass. After a while, they are given an opportunity to cut glass for a job. Eventually, helpers

assist experienced workers on simple installation jobs. By working with experienced glaziers, they eventually acquire the skills of a fully qualified glazier.

Employers recommend glaziers learn the trade through a formal apprenticeship program that lasts 3 to 4 years. Apprenticeship programs, which are administered by the National Glass Association and local union-management committees or local contractors' associations, consist of on-the-job training, as well as 144 hours of classroom instruction or home study each year. On the job, apprentices learn to use the tools and equipment of the trade; handle, measure, cut, and install glass and metal framing; cut and fit moldings; and install and balance glass doors. In the classroom, they are taught basic mathematics, blueprint reading and sketching, general construction techniques, safety practices, and first aid. Learning the trade through an apprenticeship program usually takes less time and provides more complete training than acquiring skills informally on the job, but opportunities for apprenticeships are declining.

Local apprenticeship administrators determine the physical, age, and educational requirements needed by applicants for apprenticeships and for helper positions. In general, applicants must be in good physical condition and at least 17 years old. High school or vocational school graduates are preferred. In some areas, applicants must take mechanical aptitude tests. Courses in general mathematics, blueprint reading or mechanical drawing, general construction, and shop provide a good background.

Standards for acceptance into apprenticeship programs are rising to reflect changing requirements associated with new products and equipment. Glaziers need a basic understanding of electricity and electronics in order to be able to install electrochromatic glass and electronically controlled glass doors. In addition, the growing use of computers in glass layout requires more and more that glaziers be familiar with personal computers.

Because many glaziers do not learn the trade through a formal apprenticeship program, the National Glass Association (NGA) offers a series of written examinations which certify an individual's competency to perform glazier work at three progressively more difficult levels of proficiency. These levels include Level I, Glazier; Level II, Commercial Interior/Residential Glazier or Storefront/Curtainwall Glazier; and Level III, Master Glazier.

Advancement generally consists of increases in pay for most glaziers; some advance to supervisory jobs or become contractors or estimators.

### **Job Outlook**

Employment of glaziers is expected to increase more slowly than the average for all occupations through the year 2008, as a result of anticipated slow growth in residential and non-residential construction.

Demand for glaziers will be spurred by the continuing need to modernize and repair existing structures and the popularity of glass in bathroom and kitchen design. Improved glass performance in insulation, privacy, safety, condensation control, and noise reduction are also expected to contribute to the demand for glaziers in both residential and nonresidential remodeling. Recent innovations include electrochromatic glass, water-shedding glass, distortion-free and high visibility glass, and self-tinting glass. A continuing emphasis on energy management, which encourages people to replace their old windows and doors with high efficiency products, will also spur the demand for glaziers. In addition to jobs due to employment growth, the need to replace experienced glaziers who retire or leave the occupation for other reasons is expected to create numerous openings.

People wishing to become construction glaziers should expect to experience periods of unemployment resulting from the limited duration of construction projects and the cyclical nature of the construction industry. During bad economic times, job openings for glaziers are reduced as the level of construction declines. Because construction activity varies from area to area, job openings, as well as apprenticeship opportunities, fluctuate with local economic conditions. Consequently, some parts of the country may

experience an oversupply of these workers while others may have a shortage. Employment and apprenticeship opportunities should be greatest in metropolitan areas, where most glazing contractors and glass shops are located.

Earnings

In 1998, median hourly earnings of glaziers were \$12.70. The middle 50 percent earned between \$10.26 and \$16.45. The lowest 10 percent earned less than \$7.91 and the highest 10 percent earned more than \$21.91. Median hourly earnings in the industries employing the largest number of glaziers in 1997 are shown below:

Miscellaneous special trade contractors .....	\$12.50
Paint, glass, and wallpaper stores .....	11.20

Glaziers covered by union contracts generally earn more than their non-union counterparts. According to the limited information available, average hourly earnings—including benefits—for glaziers who belonged to a union and worked full time, ranged between \$15.70 and \$43.00 in 1998. Glaziers in New York, Boston, San Francisco, Chicago, Los Angeles, Philadelphia, and other large cities received the highest wages. Apprentice wage rates usually start at 50 to 60 percent of the rate paid to experienced glaziers and increase every 6 months. Because glaziers can lose time due to weather conditions and fluctuations in construction activity, their overall earnings may be lower than their hourly wages suggest.

Many glaziers employed in construction are members of the International Brotherhood of Painters and Allied Trades.

Related Occupations

Glaziers use their knowledge of construction materials and techniques to install glass. Other construction workers whose jobs also involve skilled, custom work are bricklayers, carpenters, floor layers, paperhangers, terrazzo workers, and tile setters.

Sources of Additional Information

For more information about glazier apprenticeships or work opportunities, contact local glazing or general contractors; a local of the International Brotherhood of Painters and Allied Trades; a local joint union-management apprenticeship agency; or the nearest office of the State employment service or State apprenticeship agency.

For general information about the work of glaziers, contact:  
✦ International Brotherhood of Painters and Allied Trades, 1750 New York Ave. NW., Washington, DC 20006.

For information concerning training for glaziers contact:  
✦ National Glass Association, Education and Training Department, 8200 Greensboro Dr., 3rd floor, McLean, VA 22102.  
✦ Glass Association of North America, White Lakes Professional Building, 3310 Southwest Harrison St., Topeka, KS 66611-2279.

Hazardous Materials Removal Workers

(O\*NET 87999 and 97989B)

Significant Points

- Formal education beyond high school is not required, but good mathematics skills are important to job performance.
- Employment is expected to grow about as fast as average; job openings will be available in all disciplines, especially lead abatement and decontamination jobs.

Nature of the Work

Increased public awareness and Federal and State regulations require the removal of hazardous materials from buildings, facilities and the environment to avoid further contamination of natural resources and to promote public health and safety. Hazardous materials removal workers identify, remove, package, transport and dispose of various hazardous materials, including asbestos, lead, and radioactive and nuclear materials. The removal of hazardous materials, or “hazmats,” from public places and the environment is also called abatement, remediation and decontamination.

Hazardous materials removal workers use a variety of tools and equipment, depending on the work at hand. Equipment ranges from brooms to personal protective suits that are totally contained to avoid exposure. Depending on the threat of contamination, equipment required can include disposable or reusable coveralls, gloves, hard hats, shoe covers, safety glasses or goggles, chemical resistant clothing, face shields and hearing protection. Most workers are also required to wear respirators while working to protect them from airborne particles. These respirators range from simple versions that cover only the mouth and nose to self-contained suits with their own oxygen supply.

Asbestos is a material used in the past for fireproofing roofing, flooring and heat insulation and a variety of other uses. While materials containing asbestos are rarely used in buildings anymore, there are still structures containing the material. Fairly harmless when imbedded in materials, asbestos, when airborne, can cause several lung diseases, including lung cancer and asbestiosis.

Lead was a common building component found in paint and plumbing fixtures and pipes until the late 1970’s. Because lead is easily absorbed into the bloodstream, it can travel to vital organs and build up there. The health risks associated with lead poisoning include fatigue, loss of appetite, miscarriage, and learning disabilities and decreased IQ in children. Due to these risks, it has become necessary to remove lead-based products and asbestos from buildings and structures.

Asbestos abatement and lead abatement workers remove these and other materials from buildings scheduled to be renovated or demolished. They use a variety of hand and power tools, such as vacuums and scrapers, to remove asbestos and lead from surfaces. The vacuums used by asbestos abatement workers have special, highly efficient filters designed to trap the asbestos, which is later disposed of or stored. During the abatement, special monitors for asbestos and lead content sample the air to protect the workers; lead abatement workers also wear a personal air monitor that indicates how much lead the worker has been exposed to. Workers also use monitoring devices to identify the asbestos, lead and other materials that need to be removed from the surfaces of walls and structures.

A typical residential lead abatement project involves using a chemical to strip the lead-based paint from the walls of the home. Lead abatement workers apply the compound with a putty knife and allow it to dry. Then they scrape the hazardous material into an impregnable container for transport and storage. They also use sandblasters and high-pressure water sprayers to remove lead from large structures.

Radioactive materials are classified as either high- or low-level wastes. High-level wastes primarily are nuclear reactor fuels used to produce electricity. Low-level wastes include any radioactively contaminated protective clothing, tools, filters, medical equipment, and other items. Decontamination technicians perform duties similar to janitors and cleaners. They use brooms, mops and other tools to clean exposed areas and remove exposed items for decontamination or disposal. With experience these workers can advance to radiation protection technician jobs and use radiation survey meters to locate and evaluate materials, operate high pressure cleaning equipment for decontamination, and package radioactive materials for transportation or disposal.

Decommissioning and decontamination (D&D) workers remove and treat radioactive materials generated by nuclear facilities and power plants. They use a variety of hand-tools to break down contaminated items such as “gloveboxes,” which are used to process radioactive materials. At decommissioning sites the workers clean